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"Characteristics of the built environment and overall local-level land use patterns are increasingly being attributed to greater surface runoff, flooding and resulting economic losses from flood events".

Increasing the amount of impervious surface by one soccer field

adds

$25,718,280

in property damage per year

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Examining the impact of land use/land cover characteristics on flood losses

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Researchers Samuel Brody and Russell Blessing at Texas A&M University Galveston along with researchers Antonia Sebastian and Philip Bedient from University of Houston studied the impacts of different land use and land coverage (LULCs) in connection with flooding events. The study indicated that there was a connection between LULCs and the 7,900 properties in the Southeast Texas study area that claimed flood insurance. The study done over the Clear Creek watershed can help future developers and planners create more resilient neighborhoods and communities.

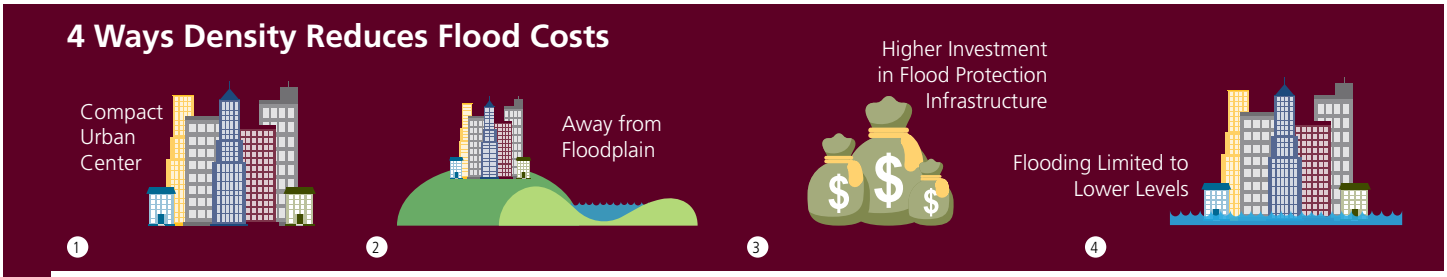
Specific development types can influence the event of destruction by floods as much as natural conditions. Not only does the development type of the flooded area impact the damages created from the storms but surrounding LULC practices can also contribute to damages and loss.

IMPERVIOUS SURFACES

Coverage of impervious surfaces (structures that are covered with materials that do not allow absorption), increase storm water runoff which escalates severity factors of floods. Human development disrupts natural systems hindering rainfall from being absorbed into the earth. This increases chances of flooding because the water stays on the surface and enters water bodies at a quicker rate- overflowing their capacity. Impacts of impervious surfaces:

- Storm water runoff doubles with only 10-20% increase of impervious surface coverage
- Peak flood onset increases 80% in urban areas containing 50% or more impervious structures
- Increases stream currents (floods occur quicker and with more velocity)
- 1 square-meter additional impervious surface = $3,602 added property damage per year

Impervious surfaces do not contribute to all factors influencing damage severity caused by flood events. Types of development patterns such as high-density clustered or low-density dispersed also influence an areas ability to manage floods.



LAND USE PATTERNS

One might think that low-density development would reduce flooding and associated damages since there is a lower amount of impervious surfaces but this is not the case. The study showed that high-density developments on average were actually better suited to reduce flooding costs and damages. While clustered developments have more impervious surfaces than suburban rural developments, they also have a number of other characteristics that benefit them that dispersed developments lack. First, clustered developments have compact and efficient urban centers in conjunction with smart growth practices that reduce flooding impacts. Second, urban developments are strategically placed away from known flood-prone areas, leading to "more resilient local communities" and minimize loss. Third, more developed areas typically have access to more resources and better "flood protection infrastructure" that can handle extra storm water runoff. Fourth, urban areas have more multi-story buildings so in flooding events, the first floor is usually the only one damaged.

Low-density suburban developments were actually shown to increase property damage. These developments increase "runoff by spreading-out impervious surfaces" which affects a larger area disrupting natural water cycles on a larger scale. Suburban and rural developments are located on the outskirts of urban developments which creates two geographical issues. One is those low-density developments do not have the same access to resources and infrastructure and are not services with adequate "hydraulic systems" or storm management facilities. The other issue created is that urban developments are located away from floodplains but the expanding low-density developments are often built up-to or into the flood areas increasing the likely hood of more severe flooding destruction.

OTHER HUMAN-FACTORS

Climate change and loss of wetlands which naturally cycle runoff and storm water amplifies worsening flood conditions. Wetlands also significantly reduce the impacts of storm surges from hurricanes and other hazards. Studies conducted in both Texas and Florida coastal communities connected increased property damage from flooding with reduction of wetland ecosystems.

Agricultural land use patterns also contribute to flooding outcomes in surrounding communities. Machinery used in agriculture practices deplete soil cycles and reduce vegetation increasing flooding. Agricultural lands also have rapid drainage systems to protect crops which are only effective in relocating runoff to surrounding developments, increasing damages in those areas.

IMPLICATIONS

Land-use-land-coverage plays a crucial role in determining the extent of flood impacts. Increased impervious surfaces (largely concentrated in urban areas) showed increased water runoff and the rapid onset of floods but the capability to manage and reduce loss in those areas. On the other hand, low-density developments showed to have larger amount of property damages and higher frequency of storm events from being closer to flood areas and lack of infrastructure.

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